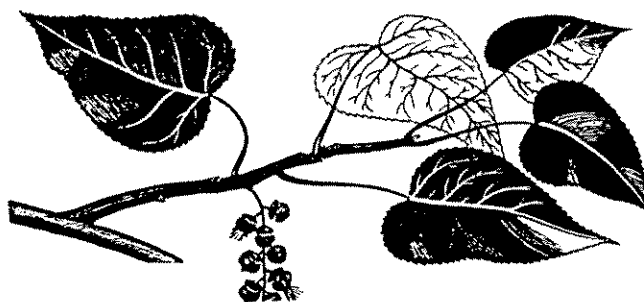


SCOTT RIVER RIPARIAN WOODLAND REVEGETATION PROJECTS

Final Report FY 1996

*"Scott River Riparian Woodland Revegetation (French Reach)"
Project 96-JITW-05*



by

CalForest Nursery, Project Subcontractor

for the

SISKIYOU RESOURCE CONSERVATION DISTRICT

Funding provided by the

KLAMATH FISHERY RESTORATION PROGRAM

Klamath River Basin Fisheries Task Force

U.S. Fish and Wildlife Service Cooperative Agreement No. 14-48-0001-96672

February 1998

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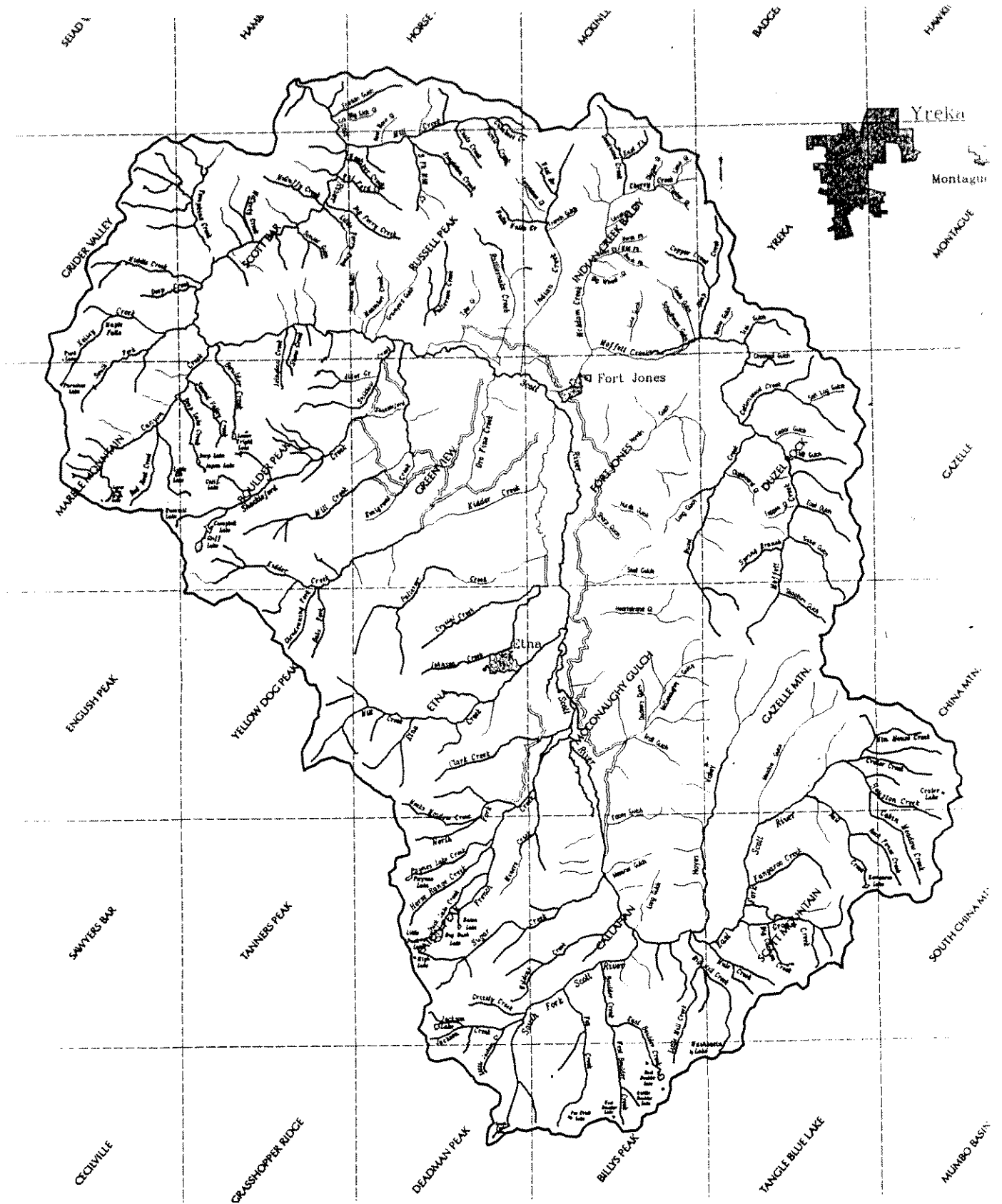
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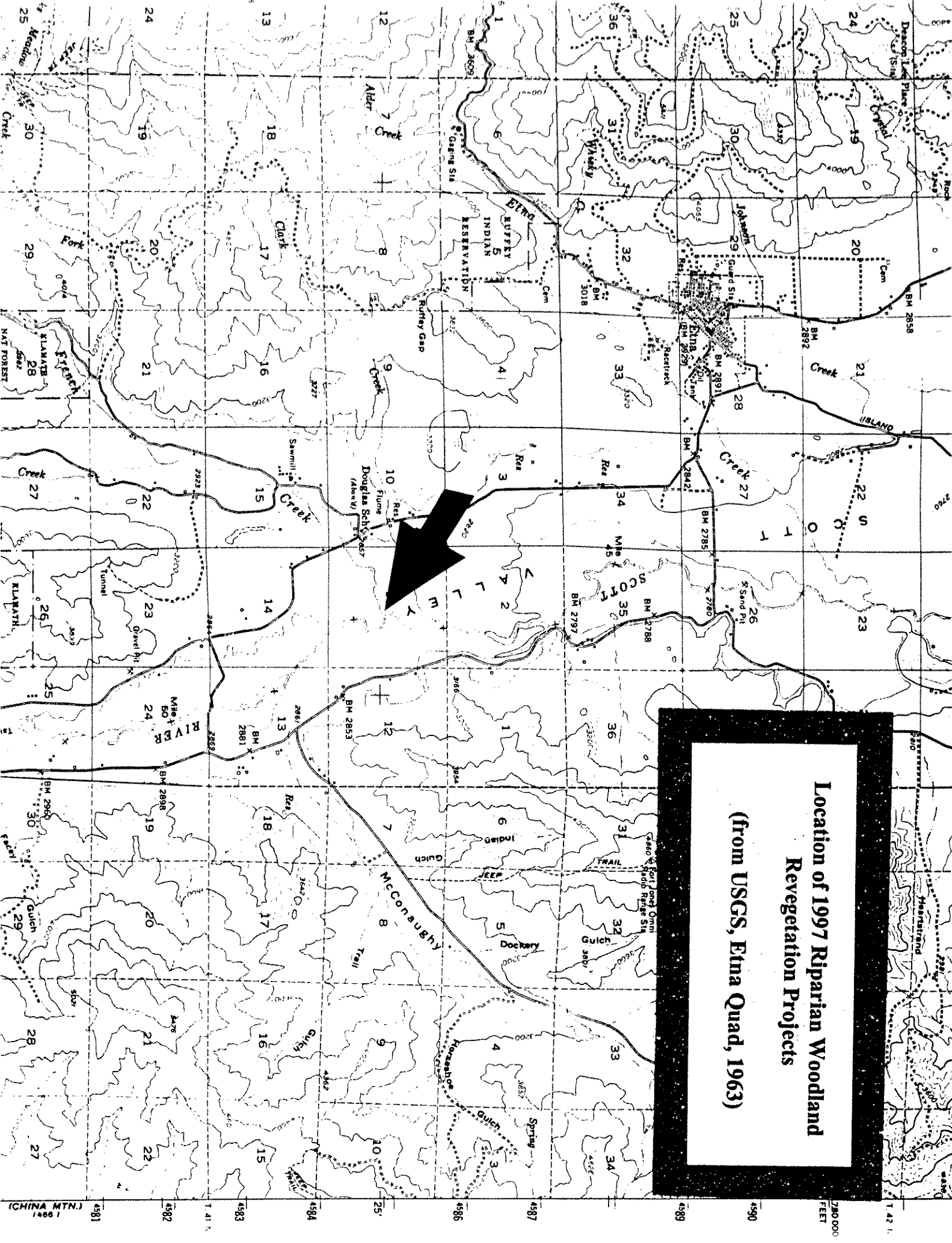
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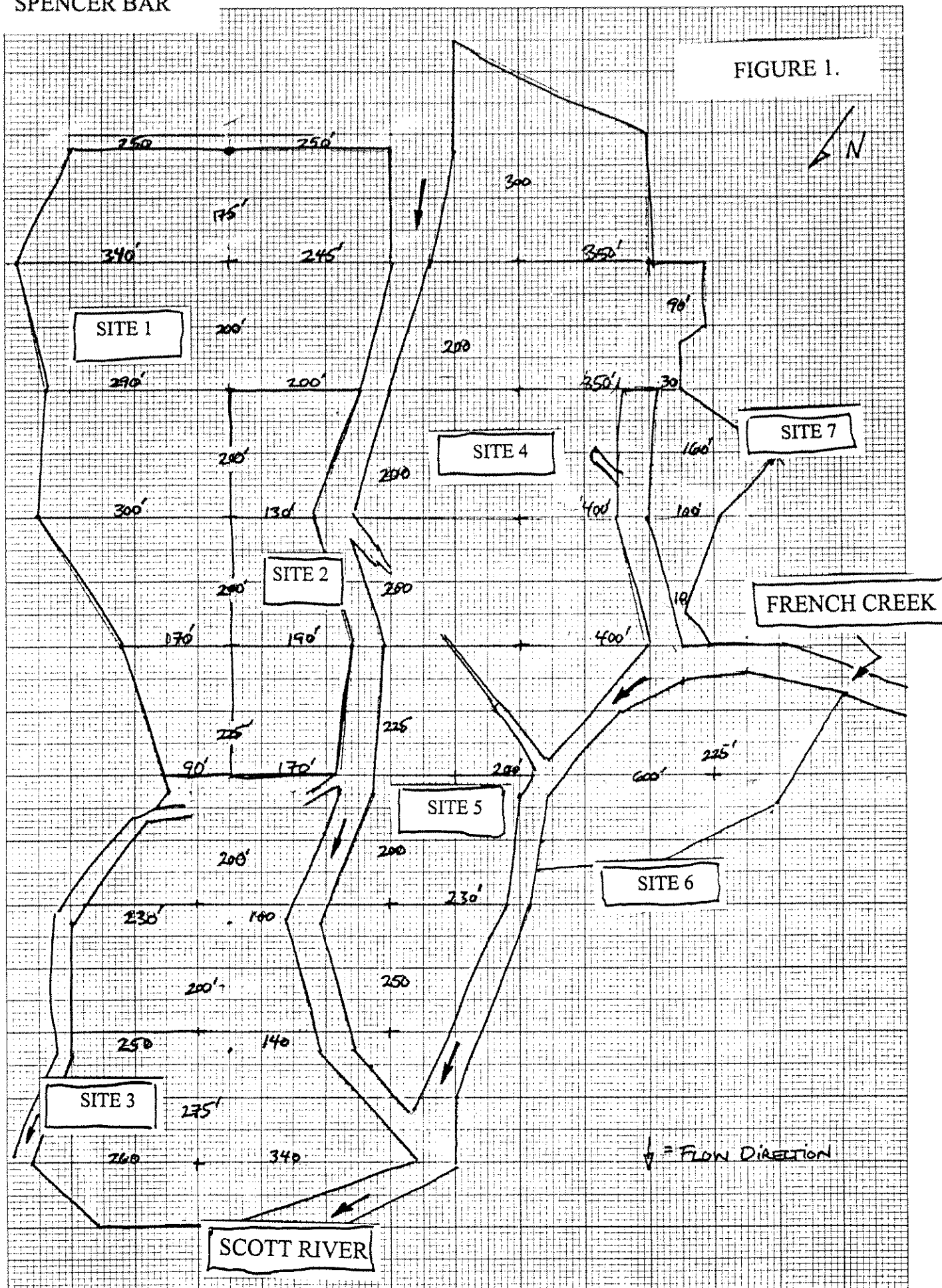


**Location of 1997 Riparian Woodland
Revegetation Projects**
(from USGS, Etna Quad, 1963)



SPENCER BAR

FIGURE 1.



SCOTT RIVER RIPARIAN WOODLAND REVEGETATION PROJECTS

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Abstract

Planting efforts of 1997 continued riparian revegetation efforts along the Scott River funded by the Klamath Restoration Program (FY 1994, FY 1995 and Jobs in the Woods). The "New Years Flood" of January 1, 1997 moved the Scott River near the confluence with French Creek approximately 400 feet to the east, altering the area to be planted considerably. The flood measured 34,300 cfs at the peak discharge, ranking it the forth largest recorded with a 14.4 year occurrence interval.

The 1997 plantings were conducted on the gravel and sand bars deposited near the mouth of French Creek after the flood. The advantages of planting the sites included: no competing vegetation and rodents, some areas with fines (nutrient) deposition, newly formed backwater areas and proximity to the water table (~ 3 feet). Survival on the large bar opposite of the French Creek confluence, the "Center Bar", averaged 77% "good" survival ("good" = plant alive, vigorous, healthy). Survival on French Creek Bar was 51% "good" . High mortality on the French Creek Bar may be attributed to heat transfer and reflection from the sandy substrate.

Strategies for improved success on gravel and sand substrate should lead to improved growth and establishment throughout the 1998 growing season. Conclusions include: 1) Earlier planting times (mid March to mid April for dormant stock , late April to mid May for non-dormant stock) provide an opportunity when site conditions are the most favorable and flexible (highest soil moisture, lower soil temperatures, initially no need to irrigate) 2) Mulching is essential in areas prone to heat stress. 3) Dry down periods between waterings promote vertical root growth and tracking of the descending water table. The right combination of planting techniques, timing and stock types which will lead to the successful establishment of trees on large acreage at low cost with few maintenance requirements is continually being sought.

SCOTT RIVER RIPARIAN WOODLAND REVEGETATION PROJECTS

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INTRODUCTION

The objective of this project is to continue the riparian woodland restoration efforts along the Scott River by growing and planting ponderosa pine, willow, cottonwood and alder seedlings along fenced portions of the Scott River. Historically extensive stands of cottonwood were found in the Scott Valley and the river, most observers would agree, was much narrower. Presently the channel (fifth order stream size) varies in width from approximately 80 to 800 ft. and existing riparian vegetation is sparse.

The Siskiyou RCD (sponsor) and Scott River Watershed CRMP projects have recently focused on *integrated riparian restoration* which includes the fencing (controlled livestock access) and planting of riparian species along the Scott River (Scott River Watershed CRMP, Fish Population and Habitat Plan, 1997). Since 1994, approximately 71 acres have been planted along the Scott River mainstem. Riparian vegetation offers shade, roughness, habitat diversity, a factor in bank building, a role in channel narrowing and the catchment of sediment during high flows.

In addition to the 17 acres funded by U.S. Fish and Wildlife, 10.5 acres were funded through Cantara - Fay Lane Project dollars.

DESCRIPTION OF STUDY AREA

The mouth of French Creek is located at T41N, R9W, Section 11 (USGS quad, McConaughy Gulch, CA.), with an elevation of 2800 ft (854m). The site has undergone extreme changes over the last year as the Scott River has shifted to the east approximately 400 feet (see attached photos). USGS flow records of the "New Years Flood" (Jan 1, 1997) include the forth largest flow on record with a peak discharge of 34,300 cubic feet per second (cfs) with a 14.4 year occurrence interval (Jay Power, USFS). For comparison, peak flows during early January 1998 were estimated at ~ 6,000 cfs and covered approximately 60% of the bars (estimates A.Eller, Cal Forest). The 1997 flood cut a new channel through the center of the existing 800 ft. (pre '97) bar and reconfigured the mouth of French Creek.

Planting areas include portions of the "Center Bar" and "French Creek Bar" (see attached maps) The newly formed center bar is approximately 11 acres and is composed of unconsolidated cobble, gravel and sand. The only existing vegetation that remained was a 20' alder tree that was protected by a pine stump (~ 5' diameter), uncovered by the recent high flows. Siskiyou RCD (G.Black, pers.comm.) mentioned that several of these large stumps had been encountered throughout the area. The French Creek bar is approximately 4 acres and is entirely decomposed granitic (DG) sand. The sand is highly reflective, porous and heat conductive which provides a challenging planting environment.

METHODS AND MATERIALS

Plant Material

Riparian plant materials included the following species of native trees and shrubs:

Pacific or Yellow Tree willow	<i>Salix lucida ssp. lasiandra</i>
Arroyo willow	<i>S. lutea</i>
Narrow leaf willow (Sand Bar)	<i>S. exigua</i>
Black Cottonwood	<i>Populus trichocarpa</i>
White alder	<i>Alnus rhombifolia</i>
Ponderosa Pine	<i>Pinus ponderosa</i>

Trees were started at Cal Forest Nursery. Dormant cuttings of cottonwood and willow were collected within an elevation range of 500' of the planting site and then started in containers (Styro 8's) in late January, 1997. Alder and big leaf maple were sown as seed into containers (Styro 8's) at the same time. Ponderosa Pine seedlings were started April 1996 (Styro 5's) and kept in cold storage until planting time. Containers were placed in a greenhouse and kept warm (~70 degrees) until adequate roots formed a "plug". Plants were moved outside to acclimate (hardened off) for 1 week before planting. These species were planted in mixes with an emphasis on the most appropriate species for the site. These sites were planted with a 40% willow, and 20% cottonwood, pine and alder mix. In addition to plug stock, approximately 1000 "whips" (800 willow and 200 cottonwood) were planted along drip lines and along low areas. Whips (willow switches) are ~1/2" in diameter and tall and straight (~ 4 ft tall).

Planting Sites and Preparation

Planting sites were located where willing landowners who had livestock exclusion and available nearby wells or water sources allowed the project. In 1997, the sites planted were located on the west side of the Scott River on the John Spencer property (see attached site maps). Access to the site was also possible through Ray Platt's property parallel to French Creek.

No site preparation was necessary on the gravel, sand and cobble substrate (site 4, 5 + 6) due to its unconsolidated nature and the lack of competing vegetation. Soil sites on the terrace (site 7) Advice was sought from a professional hydrologist on which locations would be the best to plant for long term benefits on the newly formed bars. The services of Dr. Sherm Swanson, University of Nevada Reno, were contracted for one day to provide input.

Planting

Trees were installed by Cal Forest personnel or planting crews with hoedads. Dormant stock, grown from the previous year, was planted in early spring in "opportunity areas". Opportunity areas are low lying areas which are close enough to the water table that irrigation is not required. (e.g. along newly formed back water areas). Non-dormant stock was hardened off and planted in late spring after threat of heavy frost, then irrigated through the summer and fall.

Irrigation System and Watering

Water was supplied to the site by nearby sumps and pressurized stock watering systems. Water was delivered to the site in 1" PVC pipe (schedule 200) and then reduced to 1/2" poly pipe (.60 drip tube). The drip tubes have inline emitters every 5 feet with 1/2 Gallon Per Hour (GPH) delivery rate. Spacing between drip lines equaled 15' or 20' and were laid perpendicular to the river (with a slight downstream angle). Watering schedules provided a dry down period to reduce weed growth around the plant and promote vertical root growth down towards the water table. Soil sites were watered approximately once a week, while sand and gravel sites were watered 2 or 3 times or continuously.

No pre-determined watering schedule was adhered to due to the variability in weather and water retention conditions. The general rule was to water less frequently but with longer duration and allow for a dry down period. Start and end times of watering are recorded for each site through the summer and fall (date and hours watered). See Table 2. - water schedule.

Monitoring and evaluation

Survival information is collected in the fall at each of the sites. Information was collected using a hand held data logger (Transterm TT7c08). Information was transferred, sorted and queried into a database, Paradox for Windows. Every fifth line of the drip system was inventoried (approximately 20% of the plants) using the following:

Site, Site Description, Line #, Plant #, Tree Type and Condition.

The condition is a subjective qualitative measure that lists the condition of the plant as:

Good - plant alive; shows signs of vigor and is healthy; likely to survive.

Poor - plant unlikely to survive; signs of stress, insect or rodent predation; little to no growth,

Dead - tree dead (dry, brittle, no leaves).

Missing - plant gone; due to animals, excessive weed competition, other.

RESULTS AND DISCUSSION

In October 1997, tree survival and condition was evaluated using the sampling strategy discussed in the methods section. Planting dates, numbers of trees planted and tree survival are summarized in Table 1. Survival on the center bar was good (77%), but the growth of the plants was marginal. It took approximately 3 months to observe growth of the trees. After planting, the trees produced the first set of leaves, set bud and then remained at the original planting size for some time (A.Eller, pers.comm). The establishment time on gravel substrate is longer in comparison to growth seen on sites with soil substrate with the same planting time such as the east side of the Scott River.

The area (site 6) with the lowest survival, the French Creek Bar (51%), suffered from logistical and site condition challenges. The late planting date of the French Creek Bar was the result of power supply problems to the main pump on the west side of Spencer's not being solved until mid - June. After power was restored and even with continuous watering, plants were negatively affected by reflected heat (e.g. willow plugs showed sunburn at the base). The watering schedule reflects a change from allowing a dry down period to continuous watering by the large increase in hours watered late in the summer. At this point heat damage had occurred yet watering was continued for those plants still alive. The site will be replanted in spring of 1998. Approximately 4 acres will be replanted with ~1,450 trees. Trees will be planted earlier (when flow conditions permit) and be mulched to increase soil moisture and reduce heat stress. The terrace (site 7) condition inventory was included with the bar.

The success of the "opportunity plantings" needs to be studied further. For example, some highlights include: alders planted in mid April on the downstream tip of the French Creek bar which grew to ~ 5 ft. and have withstood flows and deposition from 1998 winter flows (A.Eller, Cal Forest). The pines, in the same area also grew to 16". The plantings on the Center Bar free from irrigation, have survived (estimate A. Eller, Cal Forest). However, survival and condition percentages are unknown for the majority of trees planted. However, these plants proved irrigation is not necessary in some areas.

The "whip" stock was planted in the middle of May in wet areas around the confluence with the Scott River, scattered along drip lines and near rock work. Initially a majority of the willow and cottonwood whips died back after being planted. One speculation was the shock to the root systems as the whips were removed from the greenhouse. The whips were started in a large bed (4' x 8' x 8"), where many of the roots intertwined and were damaged upon removal. After dying back many whips resprouted from the base. This trial provided the first experience using large rooted stock which is continuing in the 1998 season.

Table 3 illustrates individual tree species performance for the French Creek bar and terrace. These trees were inventoried along the drip lines. From the results the tree with the highest survival is the cottonwood, which handles heat stress well. Low performance from the willow is due to heat kill.

Description of Problems by Site

Center Bar: Problems included: at the south end of the bar and on the terrace above French Creek, neighboring cattle heavily grazed lines on their side of the drift fence between Spencers and Tobias (upstream); plants showed little growth.

French Creek Bar: Problems included: Difficulties restoring power to the main pump on the west side of Spencer's, reflected heat from the DG sands.

Table 1. Planting Date, Quantities and Survival - French Creek Reach 1997

Location	Date	Alder	Ctwd.	Maple	Pine	Willow	Style	Good	Poor	Dead	Missing
Center Bar	4/9	90	100	140	100	275	op	77%	5%	17%	2%
	4/10	135	100	120	200	310	op				
	4/11	110	ns	ns	100	190	op				
	5/30	45	975	30	390	1,680	drip				
	totals	380	1,175	290	790	2,455	5,090				
French Cr	4/11	50	ns	ns	40	120	op	51%	16%	17%	16%
	6/28	110	150	ns	80	260	drip				
	6/28	280	280	ns	280	560	drip				
	totals	440	430	0	400	940	2,210				
Grand totals	-----	820	1,605	290	1,190	3,395	7,300				

ns = no stock available

op = opportunity planting

The original contract stated 17,000 seedlings were to be planted over 17 acres. The combined funding by the U.S. Fish and Wildlife Service and Cantara covered a total of 27.5 acres on the Spencer property with a total of ~13,000 plugs. The average planting density (plants /acre) being 473 with a total of ~13,000 plugs over the entire site (higher planting densities were substituted for planting a larger area).

SUMMARY AND CONCLUSIONS

Planting Time and Tree Stock

Experiments with early plantings this year (mid -April) raised questions about the planting time and the stock type used. Planting dormant stock may provide a method that allows maximum flexibility. The survival rate of dormant stock (held over for a year at the nursery) versus non-dormant stock (planted the same year it is collected) needs to be studied farther. Some advantages of planting dormant stock include: early spring planting when site conditions are the most favorable (high soil moisture, cool soil temperatures and less risk of frost damage to plants in dormant stage) is possible, a longer growing season is experienced and trees are not dependent on drip system operation at time of planting. The risks of planting dormant stock early in 1998 include: the unknown effects to stock quality from holding plant stock for one year ; and the possibility of late season flood flows with the larger than normal snow pack (e.g. snow depth: 3/1/98 Dynamite meadow, 115" 244% of normal; 3/1/97, 12.5", 36% of normal; 41 year average = 47.2"). Non-dormant stock performs well at various planting times when drip systems are running. Trials in 1998 will be conducted using dormant and non-dormant stock in a variety of substrates to compare which technique is preferred. The trials will show if plants are entirely dependent on drip irrigation to be established.

Tree Size

Yearly scour and deposition make the quick establishment of plugs essential. An estimated two or three growing seasons are required for 8 cu.in. plugs to establish, under correct conditions, before it can withstand heavy deposition and scour. To date, winter flows have had little affect on plug stock except where banks were eroded (estimated winter flow ~6000 cfs). On high bar sites with sandy soil, with site prep (that removes competing vegetation), and with irrigation 8 cu.in. plug stock performs well. Small plugs on soil sites can be used to cover a large area where many plants are needed and high flows are less damaging (e.g Spencer east - averaged 69% "good").

1998 planting trials with large rooted plugs (4" x 14") (R. Tollfeson, pers. comm) and willow and cottonwood pole stock will observe establishment rate, maintenance needs and survival in sand, gravel and soil substrate. In soil sites large stock will also be planted to see if irrigation is essential if stock is planted deeper .

Watering

The amount of water a site receives is dependent on the substrate and evaporation. Sites planted in 1994 and 1995 were watered continuously. This promoted weed growth and competition at the base of the tree and the trees developed surface root systems. After two years of irrigation many plants did not develop a deep enough root system to survive not being irrigated. The dry down period used this year was effective in gravel and sand areas at limiting weed establishment and promoting downward root growth

The installation, maintenance and re-installation of the drip irrigation system for a two year period is labor and time intensive. Trials will determine if using larger stock that is not dependent on irrigation (or for only one year) is more cost effective than planting smaller stock with a more involved irrigation system.

Mulch

Mulch is essential to reducing heat stress and soil moisture loss. Replanting efforts in 1998 will use mulches to reducing heat damage. Sand and gravel sites will be mulched with alfalfa hay, straw hay or ammoniated tree bark. A risk with mulch used on grassy sites (with the possible exception of tree bark), is that rodents tend to burrow underneath and girdle trees. Grassy areas do not reflect and adsorb heat to lethal levels so mulch is not necessary. Shade boards were used successfully in severe conditions (e.g. late planting , 7/97) in a hot dry sandy site on the east side of Spencer's property.

Replanting will occur this spring , 1998, on French Creek Bar (site 6 and 7) where survival was 51%. The planting will be earlier, include some larger non-dormant stock, and use mulch to reduce heat damage. Table 4. summarizes the number of trees and acreage to be replanted .

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TABLE 2.

MONTHLY WATERING SCHEDULE FOR SPENCER'S 1997
Total hours watered and times per month

SPENCERS

Site	JUNE		JULY		AUG		SEPT		OCT	
	hrs.	#	hrs.	#	hrs.	#	hrs.	#	hrs.	#
north, #3	68	3	159.5	5	161.5	5	148	4	no watering	
mid, #3	78.5	3	115	5	161.5	5	148	4		
sod., #1+2	48.5	3	114	5	186	6	201	4		
osprey, #1	58.5	3	121	6	140.5	6	115	4		
cnterbarN, #4	25?	3	108	5	237.5	5	138	5		
cnterbarS, #4	69	3	108	5	237.5	5	138	5		
terrace, #7	49	1	167	4	203.5	4	528	8		
Frnchbar, #6	48	1	238.5	4	168	4	528	8		

TABLE 3.

SPECIES PERFORMANCE AND SURVIVAL COMPARISONS
1997 PLANTINGS - SCOTT RIVER

LOCATION	SPECIES	GOOD	MISS	POOR	DEAD	TOTAL	SITE TOTAL %
FRENCHC	WILLOW	53	23	24	65	165	50%
	%	32%	14	15	39		
	COTONWOOD	37	8	7	2	54	16%
	%	69%	15	13	4		
PINE		42	10	5	11	68	21%
	%	62%	15	7	16		
ALDER		14	4	12	13	43	13%
	%	33%	9	28	30		
						330	100%

TABLE 4.

REPLANTING ESTIMATES FOR 1998
Scott river Riparian Planting

Spencer Ranch- French Creek and North Bar Replanting Summary

Location	Total acres	Redo acres	Tube spacing	Estimate # of trees	Planting technique	30% Alder	30% Ctnwd	10% Pine	30% Willow	Large Rooted	Mulch type	Time
French Cr.	2.2	1.5	15 ft.	850	hoedad, shovel	255	255	85	255	~100, 25 of each	bark,hay	March
North Bar	1.0	1.0	15 ft.	580	hoedad, shovel	174	174	60	174	~100, 25 of each	Bark,hay	March

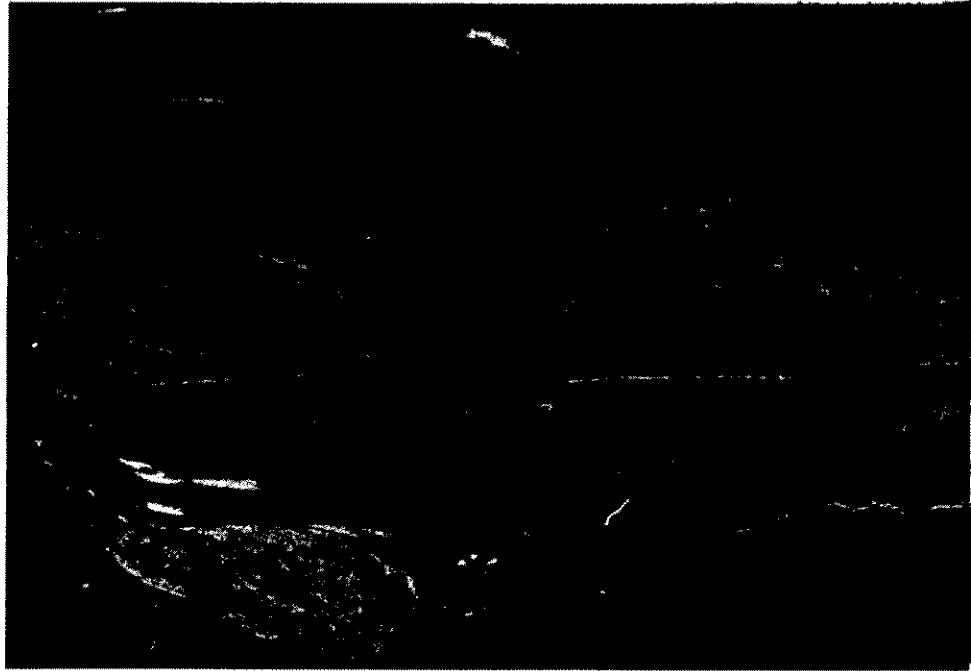


Photo taken by CalForest personnel April 1997 -
looking east from above French Creek.



1996 aerial photo courtesy of Siskiyou RCD

French Creek Bar after (above) and before (below) the New Years
Flood Jan. 1, 1997 - at the confluence with the Scott River.

NOT TO SCALE



French Creek Bar - pre-planting 1997
DG sand at the mouth



French Creek Bar - late summer 1997
sweet clover and pines visible
(picture taken farther away)



Center Bar of Spencers looking south
slow growing cottonwood in lower left

All pictures taken facing south with Mt. Bolivar in the background



Opportunity plantings - plantings in wet sand (April 1997)

Opportunity Plantings
at the downstream end
French Creek Bar -
before and after

Use the notched hill in the
background as a reference



Growth on opportunity plantings after one year (C